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Obsessive-Compulsive Symptoms and Attentional Bias: An Eye-Tracking Methodology

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## **Abstract**

**Background and Objectives:** Cognitive models suggest that attentional biases are integral in the maintenance of obsessive-compulsive symptoms (OCS). Such biases have been established experimentally in anxiety disorders; however, the evidence is unclear in Obsessive Compulsive disorder (OCD). In the present study, an eye-tracking methodology was employed to explore attentional biases in relation to OCS.

**Methods:** An opportunity sample of 85 community volunteers was assessed on OCS using the Yale-Brown Obsessive Compulsive Scale-self report. Participants completed an eye-tracking paradigm where they were exposed to OCD, Aversive and Neutral visual stimuli. Indices of attentional bias were derived from the eye-tracking data.

**Results:** Simple linear regressions were performed with OCS severity as the predictor and eye-tracking measures of the different attentional biases for each of the three stimuli types were the criterion variables. Findings revealed that OCS severity predicted greater frequency and duration of fixations on OCD stimuli, which reflect the *maintenance* attentional bias. No significant results were found in support of other biases.

**Limitations:** Interpretations based on a non-clinical sample limit the generalisability of the conclusions, although use of an analogue sample in OCD research has been found to be comparable to clinical populations. Future research would include both clinical and sub-clinical participants.

**Conclusions:** Results provide some support for the theory of *maintained attention* in OCD attentional biases, as opposed to *vigilance* theory. Individuals with greater OCS do not orient to OCD stimuli any faster than individuals with lower OCS, but once a threat is identified, these individuals are unable to redirect attention.

## **Obsessive-Compulsive Symptoms and Attentional Bias: An Eye-Tracking Methodology**

### **1. Introduction**

Obsessive-Compulsive Disorder (OCD) is a pervasive mental health problem with estimated prevalence rates ranging from 1.3 – 3% (Somers, Goldner, Waraich & Hsu, 2006; Zucker, Craske, Barriola & Holguin, 2002). The Diagnostic and Statistical Manual of Mental Disorders (DSM-V; American Psychiatric Association, 2013) defines the principle descriptors of OCD as: a) recurrent thoughts, or images (obsessions) that are considered intrusive and that cause significant distress; and b) ritualistic behaviours (compulsions) typically engaged in to neutralise obsessive thoughts. However, many of the cognitive features of OCD exist on a continuum within the general population. Zucker et al., (2002) reported that 80 – 99% of people experience intrusive thoughts and/or impulses. Moreover, such processes are thought to be important for adaptive cognitive functions such as creativity and problem-solving (Salkovskis & McGuire, 2003).

Contemporary cognitive models of OCD claim that the disorder develops and is maintained by overestimation of both personal responsibility and the level of threat posed by situations, sensations or mental events (Salkovskis, 1999; Rachman, 1997). Most individuals will regularly experience aversive intrusions in response to environmental stimuli without developing OCD. However, in clients with OCD, it is their subsequent ‘catastrophic’ negative appraisal of the intrusions and the actions they undertake to neutralise the accompanying aversive feelings that causes their Obsessive Compulsive Symptoms (OCS; Salkovskis, 2007; Frost, Skeetee, & Williams, 2002).

## 1.1 Attentional bias and OCD

In addition to the salience of appraisals and neutralising behaviours, cognitive theories of both OCD and anxiety highlight the pivotal role of attentional or information-processing biases in the maintenance of these disorders (Salkovskis & McGuire, 2003). Attentional biases are thought to develop as a result of activation of negative cognitive schemata, which, in turn, induce individuals to orientate towards environmental stimuli that are consistent with their primary fears. Both Beck's (1976) schema model and Bower's (1981) network model propose attentional biases have a substantive information-processing role in the perpetuation of anxiety and depression. Nevertheless, the exact mechanism of such biases remains unclear. Two central theories have emerged to account for attentional bias in anxiety disorders and OCD (Moritz, von Mühlenen, Randjbar, Fricke & Jelinek, 2009). The *vigilance* hypothesis suggests that individuals with OCD may be overly sensitive/hypervigilant towards obsession-related stimuli, exhibiting a 'lowered perceptual threshold' for identifying and attending to OCD-related material (Armstrong & Olatunji, 2012). In contrast, the *delayed disengagement/maintenance* hypothesis asserts that individuals with OCD do not have an enhanced hypervigilance or initially orientate more quickly towards OCD stimuli. Rather, individuals with OCD have problems either disengaging from the stimuli or overly fixating upon them at later processing stages (Georgiou et al., 2005).

## 1.2 Measuring attentional bias

Discerning the exact mechanism of OCD attentional biases (e.g., *vigilance* vs. *delayed disengagement/maintenance*) has proved challenging due to the limited technology available for testing theoretical models. Dot-probe response and modified Stroop tasks have been the

predominant paradigms used to measure attentional bias in OCD; however, research has produced inconsistent evidence.

The Emotional Stroop paradigm measures the ability to process one dimension of a multidimensional stimulus (i.e., naming the colour of text) when another dimension (i.e., emotional word meaning) interferes with this task. A response delay in colour naming is interpreted as interference as a result of automatic activation of fear-responses or mood-congruent semantic networks (Kyrios & Iob, 1998). McNally, Riemann, Luro, Lukach, and Kim (1992) found that both participants with OCD and panic disorder exhibited attentional biases towards general threat words in an Emotional Stroop task. Lavy, van Oppen & van den Hout (1994) also examined response times to OCD stimuli. Individuals with OCD took significantly longer to colour name OCD-related words compared to healthy controls, suggesting privileged attentional bias toward OCD stimuli. In terms of OCD subtypes, participants with washing compulsions have been found to display slower response times to washing-specific words than those without such compulsions (Foa, Ilai, McCarthy, Shoyer, & Murdock, 1993). The literature is clouded, unfortunately, by the fact that many of these findings have not been replicated in more recent Stroop investigations (e.g., Kampman, Keijsers, Verbraak, Naring, & Hoogduin, 2002; Moritz, Jacobsen, Kloss, Fricke, Rufer & Hand, 2004; Moritz et al., 2008).

Dot-probe experimental paradigms usually present two images simultaneously on a screen. When the images disappear, one is replaced with a probe (e.g. an 'x') and the participant is required to indicate the position of the probe. A delay in responding is expected if the individual's attention was captured by the image that was on the mirror side of the probe, as the eye must travel further. Dot-probe investigations have also yielded equivocal results with regard to OCD biases. Tata, Liebowitz, Prunty, Cameron, and Pickering (1996) and Amir, Najmi, and Morrison (2009) found evidence of attentional bias for OCD-salient

information in participants with OCD. Moritz et al. (2009) used visual stimuli rather than words and lengthened stimuli presentation times (relative to previous studies) resulting in evidence supporting the presence of attentional bias. Conversely, similar probe detection tasks found no evidence of an attentional bias (e.g., Harkness et al., 2009).

There are several possible methodological explanations for the previous inconsistent findings. Firstly, OCD Stroop words (e.g., ‘responsibility’, ‘dirt’) have often been considered not sensitive enough to evoke OCD attentional biases, especially compared to stimulus words for other disorders such as alcohol abuse (e.g., ‘beer’; Summerfeldt & Endler, 1998). In contrast, Moritz et al. (2009) found pictorial stimuli were more emotionally evocative than word stimuli and potentially more likely to elicit biases. Secondly, generic OCD stimuli may not be suitably idiosyncratic to access the attentional biases of the majority of individuals with OCD. The Obsessive-Compulsive Cognition Working Group (1997) stated that the heterogeneity of this population was the main impediment to attentional bias research. The personal nature of many OCD appraisals makes it difficult to develop a single set of stimuli that are relevant for the wider OCD population, even for members of the same subtype.

Another consideration within the literature is the overreliance on behavioural response paradigms to investigate the existence of bias (e.g., Stroop tasks, reaction times). The validity of the dot-probe task as a measure of attention has been criticised, since the human eye can shift and fixate many times within the period it takes for the probe to appear in trials (Mogg, Millar & Bradley, 2000). A more effective and ecologically valid method of measuring attentional bias is to track eye-movements in relation to set stimuli (Jonides, 1981). Eye-tracking studies have begun to operationalise distinct attentional processes using types of eye-movement pattern (Armstrong & Olatunji, 2012) and this paradigm has already been used frequently within other fields of research such as autism (Riby & Hancock, 2009) and schizophrenia (Hutton & Ettinger, 2006). Anxiety research has also employed this



paradigm with some success. Mogg et al. (2000) used both eye-tracking and a reaction-time design to explore attention to face-pairs (threatening, sad, happy, neutral) in individuals with generalised anxiety disorder (GAD) and depression. The GAD group exhibited a *vigilance* bias by orienting their gaze more quickly to threatening faces than the depression and control groups. Reaction-time tasks were unable to detect any biases in this study.

### 1.3 Eye-tracking paradigm in OCD research

Research examining attentional bias in OCD using eye-tracking methodologies is at an early stage with only a handful of studies using this approach on non-clinical populations (e.g., Armstrong Olatunji, Sarawgi & Simmons, 2010; Armstrong, Sarawgi, & Olatunji, 2012; Toffolo, van den Hout, Hooze, Engelhard & Cath, 2013). Results support the presence of attentional bias in OCD; however, there is still a lack of consistency regarding the precise type of attentional processing involved in this process (i.e., *vigilance* vs. *delayed disengagement/maintenance*). In a sample of individuals with high/low contamination fears, Armstrong et al. (2010) found evidence of attentional bias at both the *vigilance* and *maintenance* stages. However, participants with high-contamination fear demonstrated increased *vigilance* only for fearful faces, but not towards disgusted faces. The latter was contrary to hypotheses considering the specific fears of this group. The study had more consistent *maintenance* bias findings, with the high-contamination group exhibiting greater maintained attention towards both disgusted and fearful expressions. In a more recent experiment, Armstrong et al. (2012) replaced faces with scenes, and found the high-contamination group oriented gaze toward contamination threat more frequently, suggesting *vigilance* bias for contamination stimuli. No main effect was found for a *maintenance* bias towards contamination threat.

## 1.4 Current study

The present investigation aimed to build on the growing body of evidence examining OCD-related attentional biases using eye-tracking methodology. Current understanding of OCD cognitive processes remains unclear with a conflicting evidence base. Use of an eye-tracking paradigm with pictorial stimuli corrects for the limitations of previous studies and increases ecological validity. The investigation used a normative sample and aimed to explore theoretical mechanisms of OCD, specifically to identify the types of attention experienced in relation to OCD-specific stimuli (i.e. *vigilance*, *delayed disengagement*, and *maintenance*). These theorised mechanisms of bias were operationalised based on patterns of eye-movement frequently measured in the literature, as detailed above. The current study utilised a more comprehensive visual stimuli set encompassing multiple OCD subtypes (e.g., washing, checking) and rigorous experimental indices of attentional bias to fully examine these concepts.

In line with previous research (e.g., Armstrong et al., 2012), it was expected that the *vigilance* attentional bias would emerge as the most prominent type of bias in individuals with greater OCD symptoms. Specifically, it was hypothesised that obsessive-compulsive symptom (OCS) severity would significantly predict eye-tracking measures of *vigilance* attentional bias towards OCD stimuli in the overall sample. It was also hypothesised that OCS severity would not predict eye-tracking measures of *delayed disengagement*/*maintenance* bias towards OCD stimuli.

## 2. Method

### 2.1 Participants

An analogue sample of participants ( $n = 86$ ) was recruited via convenience sampling. All volunteers learned of the study through community and university advertising in Belfast, Northern Ireland (i.e., posters, online advertising on the university website). Inclusion criteria were 1) aged 18 and over; and 2) normal or corrected-to-normal vision. Exclusion criteria were 1) a pre-existing diagnosis of OCD and/or treatment history for this disorder; 2) a pre-existing medical condition that may affect vision and motor performance (e.g., Parkinson's Disease); and 3) failure for gaze to calibrate to the eye-tracker. One participant was later excluded due to problems in calibration. The final sample therefore consisted of 85 participants aged 18 – 57 years old.

### 2.2 Materials/Apparatus

#### 2.2.1 Yale-Brown Obsessive-Compulsive Scale - Self-Report Severity scale

**[YBOCS-SR].** The YBOCS-SR (Baer, 1992) is a self-administered 10-item measure of severity of obsessions and compulsions scored on a 4-point Likert scale. Internal consistency of the YBOCS-SR is acceptably high (Cronbach's  $\alpha = .88$ ; Federici et al., 2010) with excellent test-retest reliability over 1 week ( $r = .88$  (Steketee, Frost & Bogart, 1996) and good construct validity (McKay, Danyko, Neziroglu, & Yaryura-Tobias, 1995). In the present investigation, OCS severity was defined as YBOCS-SR total score.

**2.2.3 Stimuli.** In order to identify the specific relationships between OCS severity and OCD stimuli, three sets of visual images were used in the study. Neutral and Aversive stimuli were included as baseline controls to ensure that any identified biases were due to unique OCD-related processes as opposed to generic anxiety reactions to aversive imagery.

Two hundred and thirty neutral images (including 30 for practice trials) and 40 aversive images were selected from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 2008). OCD specific stimuli ( $n = 160$ ) were selected from the Maudsley Obsessive-Compulsive Stimuli Set (MOCSS; Mataix-Cols, Lawrence, Wooderson, Speckens, & Phillips, 2009), consisting of 40 images in each of the following categories: washing, checking, hoarding and order. MOCSS has good convergent validity with the OCI-R and Y-BOCS (Mataix-Cols et al., 2009) and multi-cultural relevance (Ribeiro, Pompéia & Bueno, 2005). Two images were presented simultaneously side by side on 200 slides. One image was 'Neutral' and the other was either OCD or aversive. Paired stimuli were approximately matched on colour, brightness, contrast, human content, and complexity by three independent raters with complete agreement ( $\kappa=1$ ). Each image was used only once. Images measured 4x6 cm and were placed 10 cm apart on a white background. Stimuli were presented using E-Prime version 3.0 software on a 22-inch widescreen monitor (1280 - 1024 resolution, 60 Hz).

**2.2.4 Equipment measuring eye movement.** Video-based combined pupil/corneal reflection technique was used to assess eye-movement with the iView X Remote Eye-tracking Device (RED250) from SensoMotoric Instruments (SMI). The sample rate was 250 Hz and the gaze position had an accuracy of within  $0.4^\circ$  of the visual angle. The current study explored eye fixations towards stimuli presented onscreen. A fixation was detected if the eye remained static for a duration 80 milliseconds, focusing on a particular location, with a dispersion of 100 pixels. Five eye patterns were of interest and interpreted as relevant to the stages of attention below (Sears, Thomas, Le Huquet & Johnson, 2010).

Measures of an orienting bias (indicators of *vigilance*) were:

- a) Direction of initial fixation (i.e., frequency of each type of image initially fixated upon – OCD/Neutral/Aversive)

- b) Speed of initial fixation (i.e., time between presentation of stimuli and first fixation on each stimulus type).

The measure of *delayed-disengagement* was identified as:

- a) Duration of initial fixation (i.e., length of time fixated upon the stimuli initially oriented to in each trial)

Measures of *maintenance* bias were:

- a) Cumulative duration of fixations on each stimuli type (i.e., total length of time fixated on stimuli in each trial)
- b) Frequency of fixations on each stimuli type (i.e., total number of individual fixations on stimuli in each trial)

### **2.3 Procedure**

After informed consent and basic demographic information was obtained, the eye-tracking task commenced. The participant sat approximately 70 cm from a computer screen while a 9-point calibration procedure was performed. If this process was unsuccessful after five attempts, the experiment was abandoned. This occurred with one participant. In each trial, a central fixation cross was displayed for 1000ms and this screen was replaced by the matched image pairs, which were displayed for 2000ms based on the design by Mogg et al. (2000). The eye-tracking task took approximately 20-25 minutes and commenced with 15 practice trials to familiarise the participant with task demands. Following practice, 200 trials were presented in pseudorandom order with the position of the neutral image counterbalanced across trials. The 200 trials were divided into blocks of twenty and participants were offered a brief resting period between each block. Participants were instructed to freely view the presented images as they pleased. Following the eye-tracking task participants completed the YBOCS-SR.

### 3. Results

Table 1 outlines the demographic and clinical information for the sample. In order to evaluate the hypotheses, a series of simple linear regressions were conducted. OCS severity was the sole predictor variable in every analysis. Separate regressions were performed for each of the stimuli sets (i.e., OCD, Aversive, Neutral) and the criterion variables varied according the attentional bias under investigation (e.g., *vigilance* bias: 1) direction of initial fixation; 2) speed of initial fixation).

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Insert Table 1 about here

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#### 3.2 Vigilance bias: Direction and speed of initial fixations

Direction of initial fixation and speed of initial fixation for each stimuli type were used as criterion variables to explore role of the *vigilance* attentional bias. OCS severity did not predict the direction of initial fixation to OCD stimuli ( $F(1, 83) = .19; p = .667$ ), neutral stimuli ( $F(1, 83) = .56; p = .456$ ) or aversive stimuli ( $F(1, 83) = .13; p = .910$ ). Furthermore OCS severity did not predict speed of initial fixation to OCD stimuli ( $F(1, 83) = .72; p = .404$ ), neutral stimuli ( $F(1, 83) = .70; p = .406$ ) or aversive stimuli ( $F(1, 83) = .99; p = .324$ ).

#### 3.3 Delayed Disengagement bias: Duration of initial fixation

*Delayed disengagement* attentional bias was assessed by inputting duration of initial fixation as a criterion variable. However, OCS severity did not predict the duration of initial fixation to OCD stimuli ( $F(1, 83) = .19; p = .667$ ), neutral stimuli ( $F(1, 83) = 1.07; p = .304$ ) or aversive stimuli ( $F(1, 83) = 1.26; p = .265$ ).

### 3.4 Maintenance bias: Cumulative duration and frequency of fixations

To explore *maintenance* attentional bias, cumulative duration of fixations and frequency of fixations on each stimuli type were included as criterion variables. OCS severity did not predict the cumulative duration of fixations ( $F(1, 83) = 3.03; p = .085$ ) or the frequency of fixations ( $F(1, 83) = 3.15; p = .080$ ) for neutral stimuli. Moreover, OCS severity also did not predict the number of fixations ( $F(1, 83) = 2.97; p = .089$ ) for aversive stimuli, but was shown to predict cumulative duration of fixations for aversive stimuli ( $F(1, 83) = 9.13; p = .003$ ). OCS severity explained 9.9% of the variance in the total length of time participants fixated in aversive stimuli ( $\beta = .32; t(83) = 3.02; p = .003$ ).

In terms of OCD stimuli, OCS severity significantly predicted the cumulative duration of fixations ( $F(1, 83) = 15.16; p < .001$ ) and the frequency of fixations ( $F(1, 83) = 7.93; p = .006$ ) for OCD stimuli. OCS scores explained 14.4% of the variance in the total length of time participants fixated on OCD stimuli ( $\beta = .39; t(83) = 3.89; p < .001$ ) and 8.7% of the variance of the total number of fixations participants made on OC stimuli ( $\beta = .30; t(83) = 2.82; p = .006$ ).

## 4. Discussion

### 4.1 Interpretation of findings

The present study aimed to explore the attentional biases outlined in cognitive models of OCD (e.g., Salkovskis, 1999) using a rigorous eye-tracking paradigm. As predicted by such models, greater OCS severity was found to predict increased attention towards OCD-relevant stimuli. In contrast to the study hypotheses, however, there was no evidence of a

*vigilance* attentional bias to OCD stimuli, as eye-tracking indices of this bias exhibited no relationship with OCS severity. There were also no significant findings from the *delayed disengagement* analyses. However, OCS severity significantly predicted eye-tracking measures of the *maintenance* bias when exposed to OCD stimuli and, to a lesser extent, aversive stimuli. Consequently, maintained attention emerged as the most prominent attentional process with regard to OCD-relevant stimuli.

Although unanticipated, the lack of support in the present study for the *vigilance* hypothesis in OCD has been found in some empirical investigations (i.e., Armstrong et al., 2010). Moreover, the majority of previous investigations privileging the role of *vigilance* attention in mental health disorders have been conducted on mixed anxiety/mood populations and often involving general threat images (see Armstrong & Olatunji, 2012). It may be that OCD operates via a more specific mechanism with reference to salient OCD stimuli. Whilst OCS has no bearing on initial fixations and ability to disengage from stimuli, it may cause individuals with higher OCS to repeatedly re-orientate and fixate upon OCD stimuli over time, thus maintaining levels of distress.

As the maintenance stage of attention is considered goal-driven and indicative of higher cognitive processing (Corbetta & Shulman, 2002), the bias observed in the current study could be attributed to activated internal schemata that perpetuate OCD symptoms and cognitive actions (Beck, 1976; Bower, 1981; Rachman, 1997). Salkovskis' (1999) proposes that awareness of intrusive images or thoughts (i.e., early stimulus perception) is not unique to OCD, but that the tendency place greater value on the significance of these thoughts (i.e., later stimulus elaboration/rumination) differentiates those with and without OCD. Similarly in this study, it appears that earlier attentional processes such as *vigilance* for OCD-fear relevant and general threat has no relationship with OCS. However, later attentional processes in response to detection of a 'threat' were related to OCS. Perhaps, as with over-



valuing intrusive thoughts (Rachman, 1997), individuals with greater OCS over-focus their later attention towards threatening stimuli. The combination of these two factors would dramatically increase the severity of misappraisals and obsessions, which in turn leads to greater compulsive behaviours designed to neutralise these aversive phenomena (Rachman, 1997).

## **4.2 Clinical Implications**

Formulation forms a key aspect of psychological intervention in which theoretical knowledge is married with idiosyncratic client information. The present study adds to current understanding of the precise attentional biases that maintain OCS, which enhances clinician ability to formulate and ultimately appropriately treat client OCD presentations. Moreover, the findings illustrate the importance of enquiring about patterns of attention and salient OCD environmental stimuli during initial assessment sessions. Treatments focusing on the reduction of attentional biases identified in the present study are also likely to be useful. Attentional control has shown remarkable plasticity (Posner & Rothbart, 2007), indicating the potential for attention-control training. MacLeod, Rutherford, Campbell, Ebsworthy and Holker (2002) manipulated attentional biases to threatening information in a non-clinical undergraduate sample, concluding that this approach has clinical implications for the amelioration of negative biases and symptoms. Indeed, evidence exists of the effectiveness of attentional control training in mediating OCD symptoms (Hakamata et al., 2010; Klumpp & Amir, 2010). Moreover, eye-tracking equipment could be utilised as a new intervention training tool in itself for exposure therapies or attention redirection training. Eye-tracking, attentional control, and severity of attentional bias also have the potential to be indicators of therapeutic progress for treatment plans employing other effective OCD therapies (e.g., Exposure Response Prevention [ERP]; Salkovskis & Kirk, 1989). Monitoring obsessions,

compulsions, and attentional biases in response to an OCD ERP intervention could more accurately gauge therapy outcome.

### **4.3 Limitations**

The size of the participant sample in the current study was greater than the majority of eye-tracking research; however, interpretations based on a non-clinical sample with low levels of OCS limit the generalisability of the conclusions. Nevertheless, use of an analogue sample in OCD research has been found to be comparable to clinical populations and also an important alternative in terms of the potential ethical issues involved in exposing clients with OCD to feared stimuli (Mataix-Cols, Junque, Sanchez-Turet, Vallejo, Verger, & Barrios, 1999). Ideally, future research should include both clinical and sub-clinical groups from a wider educational background, and compare these groups on attentional biases in a robust experimental design. The use of a unitary global measure of OCS is also a limitation. The identification and exploration of attentional biases in relation to different OCD subtypes and symptoms (e.g., contamination, checking) could glean a more exact understanding of the topography of these processes. Lastly, the MOCSS stimuli set used in the study was developed before the hoarding subtype was removed from the DSM-V OCD diagnosis. Although the reclassification of hoarding remains controversial (e.g., Stein & Phillips, 2014) and this type of stimuli represented only one aspect of the MOCSS set, this limitation should be borne in mind when making interpretations.

### **4.4 Future research**

Future research would benefit from focussing on further manipulations of the eye-tracking paradigm to test additional hypotheses, such as inclusion of supplementary probe-detection tasks and saccade measurement. Of particular note, the development of more

sophisticated stimuli and measurement techniques to assess and compare idiosyncratic OCD presentations would improve our understanding of attentional biases. Whilst the images used in this study were validated (Lang et al., 2008; Mataix-Cols et al., 2009), further comprehensive validation of OCD stimuli sets/paradigms in line with DSM-V and OCD theoretical developments will progress this research area. Lastly, real-life eye-movement behaviour in OCD is an area of research largely unexplored and there is need for future research assessing attentional processes in everyday life.

#### **4.5 Conclusion**

The current findings provide evidence that specific attentional biases are related to obsessive-compulsive symptomatology. These biases, however, do not appear to be at the *vigilance* stage of attention, as would be expected. Rather, greater OCS is predictive of enhanced *maintenance* attentional processes toward OCD and aversive stimuli. Future investigations should attempt to replicate these findings using rigorous experimental designs and clinical OCD samples. The identification of these specific biases in OCD have implications for assessment and intervention. Further analysis and improvements on technology will increase the ability to explore these phenomena, as more in-depth analysis of underlying processes is possible.

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### **Declaration of Interest**

The authors would like to declare that this research was a student project completed by the first author for her doctoral qualification in clinical psychology. No grants or finance was obtained to support this project. There are no actual or potential conflicts of interest including any financial, personal or other relationships with other people or organizations within three years of beginning the submitted work that could inappropriately influence, or be perceived to influence, this work.

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**Table 1.** Demographic and clinical characteristics of the sample

<b>Demographic/Clinical Variable</b>	<b>Sample [<i>n</i> =85]</b>
<b>Gender (%)</b>	
<i>Female</i>	59 (69.4%)
<i>Male</i>	26 (30.6%)
<b>Mean Age (SD)</b>	26.27 (9.41)
<b>Mean Years in Education (SD)</b>	16.38 (2.69)
<b>Educational Qualifications (%)</b>	
<i>No educational qualifications</i>	2 (2.4%)
<i>GCSE <sup>1</sup> or equivalent</i>	2 (2.4%)
<i>A-level <sup>2</sup> or equivalent</i>	47 (55.3%)
<i>Further education below degree</i>	2 (2.4%)
<i>Degree and above</i>	32 (37.6%)
<b>Mean YBOCS-SR scale scores (SD)</b>	
<i>Total</i>	6.45 (5.98)
<i>Obsessions</i>	3.19 (3.17)
<i>Compulsions</i>	3.26 (3.48)
<b>YBOCS-SR categories (%)</b>	
<i>Subclinical (0 – 7)</i>	57 (67.1%)
<i>Mild (8 – 15)</i>	23 (27.1%)
<i>Moderate (16 – 23)</i>	4 (4.7%)
<i>Severe (24 – 31)</i>	1 (1.2%)
<i>Extreme (32 – 40)</i>	0 (0%)

<sup>1</sup> GCSE refers to the British assessment undertaken by school student at approximately the age of 16.

<sup>2</sup> A-level refers to the British assessment undertaken by student at approximately the age of 18.